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INSTRUCTIONS

FOR

TYPE 98 DC AMPLIFIER

SERIAL NO. 1041 AND UP

rustrak® INSTRUMENT COMPANY, INC.

A SUBSIDIARY OF GI GULTON INDUSTRIES, INC.

MANCHESTER MUNICIPAL AIRPORT
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1. WARRANTY

The Rustrak Instrument Company, Inc. warrants each instrument of its manufacture to be free from defects in material and workmanship for a period of ninety days after purchase. Our obligation under this warranty is limited to replacing any part(s) which shall, upon examination by our factory, be determined to have been defective. Subsequent improvements on this equipment does not obligate the Rustrak Instrument Company to apply same to equipments previously sold.

2. DESCRIPTION

The Type 98 DC Amplifier is designed to operate on 105 to 125 volts, 50 or 60 cycles. A power cord and inter-connection cable and plug assembly is supplied. The amplifier plug is plugged into the rear mating connector on the amplifier and the extension is plugged into the rear mating connector on the recorder. The power plug on the power cord is a standard two wire with ground terminal for connection to a standard grounding type AC receptacle. When this plug is used with an adaptor, the grounding lug must be connected to a ground to minimize the possible unstable operation of the amplifier. To assure freedom from drift, a good ground, such as would be supplied by a grounded type receptacle, must be used.

The input resistance between the negative terminal and the volts terminal on the front panel of the recorder is 1 megohm in all ranges. The negative terminal is not grounded to the chassis or cabinet of the amplifier and floats through a 1 microfarad capacitor from the negative terminal to the chassis. It is therefore pointed out that the input of the amplifier is floating, but is not

balanced. The negative terminal should be kept at AC ground, but may have DC voltages up to 100 volts off ground. Note that the negative input terminal and the positive output terminal are common.

The Type 98 DC Amplifier may be used to amplify signals from either high or low impedance sources, such as photo-electric devices, thermistors, thermocouples, strain gauges, etc. Care must be taken that the amplifier is not used in large AC fields at the power line frequency, because such fields will either add to, or subtract from, the true DC reading, depending on the phase difference.

When a current source is connected between the negative input terminal and the microampere terminal, currents of 1 to 10 UA may be read with extreme accuracy. The DC resistance at these terminals is 10,000 Ω maximum at 1 UA.

The output impedance is high and can be connected to any load with a resistance range of 0 to 5000 Ω. A series resistor of 1500 Ω is included in the amplifier so that shorting the output will not damage the amplifier circuits. The calibration control will have to be adjusted for the load impedance used, if maximum accuracy is required. It is factory adjusted for a 100 Ω load. This amplifier, when used with a 1 MA meter or recorder, will produce the full scale voltages or currents indicated on the front panel. When used with a 200 UA meter or recorder, the voltages and currents indicated on the panel are divided by five. Therefore, the maximum sensitivity is .002 volts or 0.2 UA. When used with a 100 UA galvanometer, the maximum sensitivities are divided by ten. Therefore, the input sensitivity will be .001 volts and 0.1 UA. However, when used with these more sensitive instruments, it should be noted that the accuracy, linearity and drift factors must be multiplied by the same difference. For example, the

linearity of the amplifier is rated at 0.1% with a 1MA galvanometer. When used with a 200 UA galvanometer, this linearity becomes 0.5%.

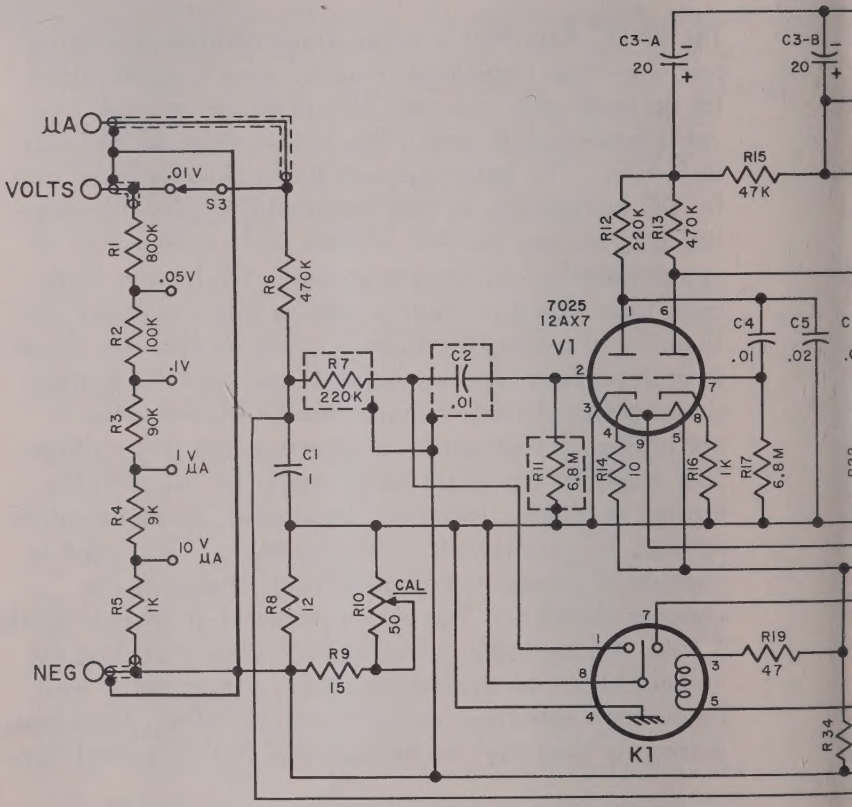
3. PRINCIPLES OF OPERATION

The 98 DC Amplifier is a two-stage resistance coupled and one-stage transformer coupled amplifier, designed for optimum gain between 50 and 60 cycles. AC inverse feed-back is used in the output stage to minimize distortion. The input and output are chopper stabilized for DC conversion, so that the amplifier will only amplify DC, or very low AC, signals up to a frequency of approximately 5 cycles per second. DC inverse feedback from output to input is used to insure stability and linearity at a sacrifice in gain. This method was chosen in preference to directly coupled vacuum tube or transistorized amplifiers, because the 98 DC Amplifier is not subject to changes in temperature and line voltage. This amplifier was designed primarily for use with the Rustrak recorder. However, because of its conservative ratings, it is usable with other recorders. The input is capable of severe overloads without damage to the chopper assembly. The output saturates at approximately 5 MA. Accordingly, all of the circuits, including the vacuum tube and chopper assembly, are operated well below their rated dissipation characteristics. Therefore, extremely long life can be expected from this amplifier.

4. PREPARING A NEW AMPLIFIER FOR USE

When a new amplifier is removed from its shipping carton, it will be noted that four accessories accompany the unit. They are as follows:

a. Inter-connecting cord set
b. Chopper assembly



NOTE

1. ALL RESISTORS IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS IN MFD.
3. DOTTED LINE INDICATES SHIELDING

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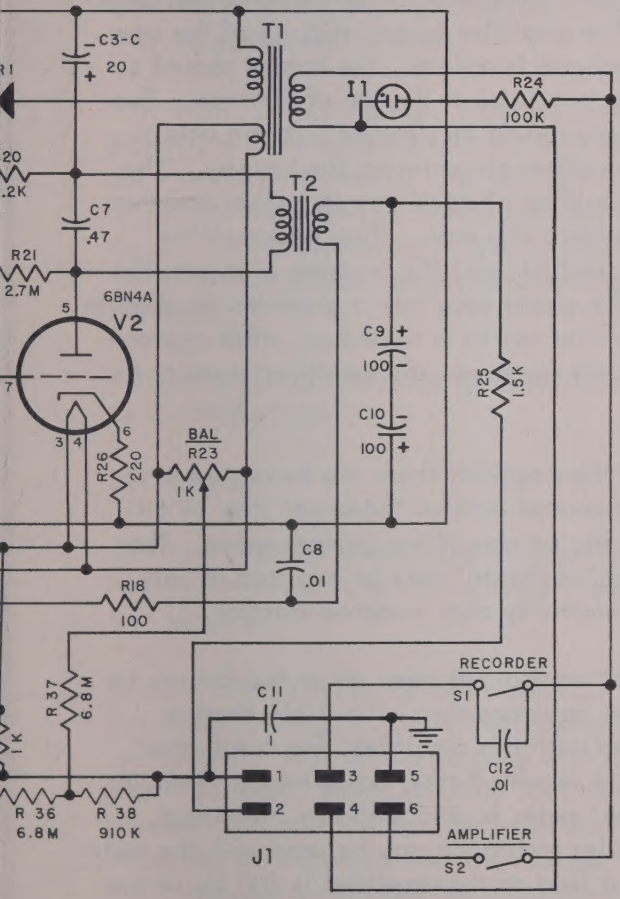


J1 CONNECTOR

1 METER +
2 METER −
3 MOTOR
4 MOTOR & AC LINE
5 GROUND
6 AC LINE

R SCHEMATIC

I AND UP)

c. Type 6BN4A vacuum tube
d. Portable or panel mounting hardware

The amplifier should be removed from its housing by unscrewing the thumb screw in the left hand upper corner of the front panel and the left hand lower corner in the rear. The amplifier is then slid out of the case. If portable hardware is ordered, the handle should be mounted in the two holes at the top of the case. The chopper assembly should be plugged into the octal socket with the offset pin entering the keyway. The output tube should be plugged into its socket and the amplifier replaced in its case. Plug the amplifier plug into the amplifier and the recorder plug into the recorder and the power plug into a grounded receptacle. When the amplifier switch is turned on, after approximately 5 minutes warm-up, the amplifier is ready for use.

At the rear of the amplifier there are two screwdriver controls. The control marked "balance" may be adjusted to zero the pointer of the galvanometer. The control marked "calibrate" may be adjusted to vary the over-all sensitivity over a narrow margin.

The "calibrate" control has been set at the factory for a 100 Ω, 1 MA galvanometer. If a 1 MA Rustrak recorder is used with this amplifier, the "calibrate" control does not require further adjustment. However, if a 1 MA panel meter is used with this instrument, appropriate series resistance may be used with the meter so that its total load on the amplifier is 100 Ω, or the "calibrate" control may be re-adjusted to compensate for the different load resistance. The calibration control should not be adjusted unless a suitable reference voltage or current of known value is available to calibrate against. When such reference standards

are available, it may be possible to use the calibration adjustment to compensate for small errors in the Rustrak or indicating instrument used with the amplifier. This amplifier may be used to drive Rustrak recorders, indicating instruments, meter relays, etc. Any combination of these, not totalling more than 5K resistance, may be connected in series.

This amplifier is bi-polar. That is, a reversal of input polarity will reverse the output, so it may be used with zero center instruments. For any setting, the voltage or current indicated on the switch markings will produce 1 MA at the output. Smaller input voltages or currents will produce proportionally smaller output currents.

THIS AMPLIFIER MUST BE GROUNDED FOR NOISELESS OPERATION.

6. SERVICE

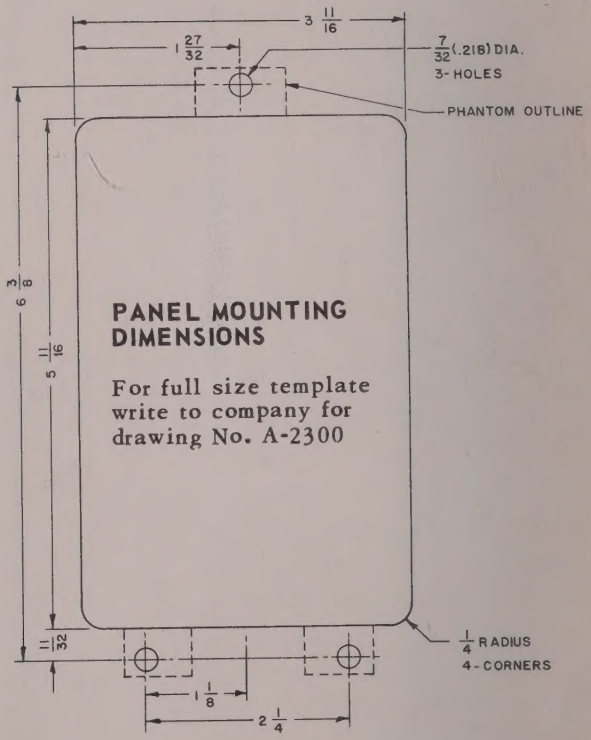
This instrument is guaranteed for a period of ninety days. However, it will give many years of trouble-free service.

When a tube(s) or the chopper assembly is replaced, the amplifier may require an adjustment of the calibration control. This should be done with a known input signal voltage. Approximately 5000 hours of life can be expected from the vacuum tubes and at least 3000 hours can be expected from the chopper assembly. However, chopper assemblies have operated for periods well beyond this expectation. Faulty chopper operation will be indicated by "spikes" appearing in the recording. The chopper assembly should be replaced after 5000 hours of use, regardless of its apparent condition.

When trouble developes requiring factory assistance, re-package the equipment in a carton equal to the original packaging. Affix a letter giving all details of the trouble to the outside of the package and forward package to:

Rustrak Instrument Company, Inc.
Municipal Airport
Manchester, New Hampshire 03103
Attention: Servicing Department

NOTES


3 11/16
1 27/32
7/32 (.218) DIA.
3-HOLES
PHANTOM OUTLINE
6 3/8
5 11/16
11/32
PANEL MOUNTING
DIMENSIONS
For full size template
write to company for
drawing No. A-2300
1/4 RADIUS
4-CORNERS
1 1/8
2 1/4